(54) METHOD AND SYSTEM FOR DETECTING NETWORK FAULT

(57)Abstract:

PROBLEM TO BE SOLVED: To minimize the waiting time of a client system before declaring the disconnection of a data communication link.

SOLUTION: This system and method dynamically changes a file system request time-out value based on an actual time required for serving the request of each file system 524. In one state, a time-out value 532 is decided to each request type based on an actual responding time and the buffer time of each request type. A response timer operates based on reading from a system clock, namely as the process of a low overhead. A monitoring system periodically tests a server to ensure the existence of physical connection.

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CLAIMS

[Claim(s)]

[Claim 1] In the network system which connects source equipment to one or more target equipments In what operates through one of the arbitration of two or more communication links which it is the approach minimal delay detects network failure, and said network system has adjustable communication-band width of face, and is easy to receive intermittent cutting by failure The step which initializes the network-services demand timeout period of 1 equipment of said one or more target equipments, As opposed to each of two or more network-services demands to said 1 equipment of said one or more target equipments The step which publishes said network-services demand through said communication link, The step which notifies network failure when said network-services demand is not filled within said timeout period, How to contain the step which repeats and performs the step which measures between network-services demands, and the step which answers between said network-services demands and changes said timeout period, when said network-services demand is filled.

[Claim 2] The approach according to claim 1 said initialization step contains the step which receives the minimum time out value and the maximum time out value to each of said target equipment, and the step which sets said network-services demand timeout period as said maximum time out value to said 1 equipment of said one or more target equipments.

[Claim 3] The step said measurement step remembers [ said source equipment ] read-out and the 1st system clock value to be for said system clock to a storage region including a system clock, When said network-services demand is successfully completed before termination of said timeout period The approach containing the step which determines read-out and the 2nd system clock value for said system clock, and the step which determines between said network-services demands as a difference of said 2nd system clock value and said 1st system clock value according to claim 1.

[Claim 4] When between said network-services demands is larger than said minimum time out value, the sum of between said network-services demands and a service request buffer interval or said maximum time out value is [ the step at which said modification step sets said timeout period as said minimum time out value when between said network-services demands is said below minimum time out value, and ] an approach containing the step set as the smaller one according to claim 2 either about said timeout period.

[Claim 5] The step to which said advice step initializes an independent timer by said timeout period, and when said network-services demand is published The step which puts said independent timer into operation, and the step which cancels said

independent timer when said network-services demand is filled, before said independent timer completes said timeout period, The approach according to claim 1 of canceling said network-services demand, canceling said independent timer, and containing the step which notifies said network failure, when said independent timer completes said timeout period, before filling said network-services demand.

[Claim 6] The approach according to claim 4 which said network-services demand is one of the arbitration network-services demand type [ two or more ], and said service request buffer value and said timeout period are memorized, and is independently applied to said each network-services demand type.

[Claim 7] The approach according to claim 1 said network-services demand is a low file system demand.

[Claim 8] The approach according to claim 1 of answering advice of said network failure and containing the step which sets said source equipment as a cutting condition.

[Claim 9] The approach according to claim 8 of containing the step which tests the connection condition of said network, and the step which tests a connection condition periodically between the periods of the arbitration which has said source equipment in said cutting condition, before publishing a network-services demand.

[Claim 10] The approach according to claim 9 of answering that said target equipment cannot notify having received said network-services demand after trial of the count of predetermined, and containing the step which sets said source equipment as a non-active state, and the step which transmits a signal to said source equipment from said target equipment on the occasion of re-connection.

[Claim 11] The approach according to claim 8 of containing the step which fills said network-services demand from a source equipment cache, when said source equipment is in said cutting condition.

[Claim 12] In the network system which is the computer program product used in the distributed computer system connected to a network system, and connects source equipment to one or more target equipments A computer usable medium including a computer read-out possible program code means for minimal delay to detect network failure is included. In that to which said network system operates through one of the arbitration of two or more communication links which has adjustable communication-band width of face, and is easy to receive intermittent cutting by failure A computer read-out possible program code means to direct to a computer that said computer program product initializes the network-services demand timeout period of 1 equipment of said one or more target equipments, As opposed to each of two or more network-services demands to said 1 equipment of said one or more target equipments A

computer program product means to direct to publish said network-services demand through said communication link to computer system, A computer program product means to direct to notify network failure to computer system when said network-services demand is not filled within said timeout period, A computer program product means to direct to measure between network-services demands to computer system when said network-services demand is filled, A computer program product means to direct to answer between said network-services demands and to change said timeout period to computer system, A computer program product including a computer program product means to direct to the method computer system of **********.

[Claim 13] A computer program product including a computer program product means to direct to receive the minimum time out value and the maximum time out value to computer system, and a computer program product means to direct to set said network-services demand timeout period as said maximum time out value to said 1 equipment of said one or more target equipments to computer system according to claim 12. [ as opposed to each of said target equipment, in the computer program product means for said initialization ]

[Claim 14] Said source equipment contains a system clock. The computer program product means for said measurement A computer program product means to direct to memorize read-out and the 1st system clock value for said system clock to a storage region to computer system, When said network-services demand is successfully completed before termination of said timeout period A computer program product means to direct to determine read-out and the 2nd system clock value for said system clock to computer system, A computer program product means to direct to computer system that between said network-services demands determines as a difference of said 2nd system clock value and said 1st system clock value, ******, a computer program product according to claim 12.

[Claim 15] When the computer program product means for said modification is [ between said network-services demands ] said below minimum time out value, A computer program product means to direct to computer system that said timeout period sets it as said minimum time out value, When between said network-services demands is larger than said minimum time out value, Said timeout period The sum of between said network-services demands and a service request buffer interval, Or said maximum time out value is a computer program product including a computer program product means to direct to set it as the smaller one to computer system according to claim 13, either.

[Claim 16] A computer program product means to direct to computer system that the

computer program product means for said advice initializes an independent timer by said timeout period, A computer program product means to direct to put said independent timer into operation to computer system when said network-services demand is published, A computer program product means to direct to cancel said independent timer to computer system when said network-services demand is filled, before said independent timer completes said timeout period, Before filling said network-services demand, when said independent timer completes said timeout period, The computer program product according to claim 12 which cancels said network-services demand, cancels said independent timer, and includes a computer program product means to direct to notify said network failure to computer system.

[Claim 17] The computer program product according to claim 15 which said network-services demand is one of the arbitration network-services demand type [ two or more ], and said service request buffer value and said timeout period are memorized, and is independently applied to said each network-services demand type.

[Claim 18] The computer program product according to claim 12 said whose network-services demand is a low file system demand.

[Claim 19] The computer program product according to claim 12 which answers advice of said network failure and includes a computer program product means to direct to set said source equipment as a cutting condition to computer system.

[Claim 20] A computer program product including a computer program product means to direct to test the connection condition of said network to computer system before publishing a network-services demand, and a computer program product means to direct to computer system that a connection condition tests periodically between the periods of the arbitration which has said source equipment in said cutting condition according to claim 19.

[Claim 21] The computer program product according to claim 20 which answers that said target equipment cannot notify having received said network-services demand after trial of the count of predetermined, and includes a computer program product means to direct to set said source equipment as a non-active state to computer system, and a computer program product means direct to transmit a signal to said source equipment from said target equipment to computer system on the occasion of re-connection.

[Claim 22] A computer program product including a computer program product means to direct to computer system that said network-services demand fills from a source equipment cache when said source equipment is in said cutting condition according to claim 19.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the distributed data processing system which accesses data from a remote server about an electronic data processing system. This invention relates to the equipment and the process which carry out the monitor of the low file system demand on the network of adjustable bandwidth more at a detail.
[0002]
[Description of the Prior Art] Each computer system is often connected to other computer system by a local area network (LAN) or the wide area network (WAN). The system which interconnects can share system resources, such as disk storage and a printer. A client/server system is realized in this environment by distributing processing, storage, or a function between a client workstation and a server workstation. A client workstation generates a demand and the demand is filled by the server workstation.
[0003] A LAN/WAN network is usually realized so that each workstation may have the splice of the bandwidth with a server given a definition. A splice and the bandwidth given a definition offer the comparatively uniform access time between a client system and a server system.
[0004] A distributed terminal system is realized using the asynchronous connection between a terminal and computer system. Asynchronous connection can mind a dedicated line or a dial telephone call circuit. Asynchronous process permits a great change of transmission speed. Each demand on a system may be answered so that cutting or delay in transmission may be recognized by the system and may be processed. Lost transmission may be resent until the whole message is received. Although asynchronous process permits a very variegated connecting medium, it serves as a low speed by the usually bigger overhead than the LAN workstation by which direct continuation is carried out.
[0005] The network commercial scene which continues growth induced the approach of a large number which interconnect a workstation. One approach makes asynchronous

connection to LAN possible by the telephone line. This approach is found out in an IBM LAN Distance program product. This product enables a client workstation to carry out dial connection to LAN from a remote location. This technique requires specific LAN Distance software in both a client workstation and a server workstation.

[0006] Another interconnect technique is infrared (IR) connection. The wireless system which carries out data transmission of the conventional wiring with an infrared signal permutes infrared direct access connection (IRDA). One fault of an IRDA system is that the physical failure within a vision pass path produces intermittent cutting of infrared equipment. The software which operates through an IRDA link must be able to continue processing through intermittent cutting.

[0007] A radio frequency (RF) link is the another wireless approach for connecting with LAN. A RF signal also receives intermittent interruption.

[0008] A cellular phone technique offers the still more nearly another wireless approach for LAN connection. A cellular signal receives interruption by physical failures, such as interruption by exchange, a tunnel, or structure.

[0009] These techniques offer the device in which the data communication link to a remote client is established. These devices are included in the migration product of a large number used by people who are increasing in number. In order to carry out direct continuation to a server from a remote device, a radiocommunication data link is often used for migration products, such as laptop or a palmtop computer system, and a Personal Digital Assistant (PDA).

[0010] The computer which functions as a server to a migration client contains the server file management system which usually enables a client system to memorize and access a file on a server. This file management system is a part of server Network Operating System (NOS). In such a system, he is IBM. A LAN server program product and the NetWare program product of a novel company are contained. Furthermore, server file systems, such as a Network File System (NFS) and an Andrew file system (AFS), are offered on the server based on a UNIX operating system (UNIX is the trademark monopolistically approved in the U.S. and a foreign country through X/Open Company Ltd).

[0011] The existing server file system compensates temporary cutting by assigning a timeout period to each of a low file system access request. When a demand is not filled within a timeout period, a data communication link is cut and a system notifies that processing is suspended.

[0012] It is difficult to determine a suitable time out value to a low file system demand. When a timeout period is set up not much short, a system will notify cutting only by a

signal having intermittent interruption. however, according to selection of a long timeout period, before a system detects true data communication unlinking, it is potentially long -- period standby can be carried out. A time out value is set as a value also with a big twist required to usually avoid the mistaken disconnect indication. Selection of a time out value is further complicated according to the data that both a long period and a short period must be supported, in order to support the migration equipment which has the data communication link of the type with which almost all servers differ.

[0013] In finding out the time-out technique which minimizes the time amount needed in order to detect actual cutting, supporting appropriately intermittent cutting by interruption of a temporary communication link, a technical problem exists.

[0014]

[Problem(s) to be Solved by the Invention] Therefore, the object of this invention is measuring actual delay of a proper to the data communication link established by client workstation, and adjusting a file system demand time out value based on the measurement.

[0015] Another object of this invention is offering the equipment which minimizes the time amount demanded in order to distinguish intermittent cutting of a communication link, and perfect cutting and to detect actual cutting.

[0016] Still more nearly another object of this invention is recognizing the processing delay of a proper to the file system demand of each type, and providing it with the approach of establishing another time out value, to the file system demand of a different type.

[0017] Still more nearly another object of this invention is offering a single file system demand time-out technique to connection of two or more types which have different bandwidth and different cutting frequency.

[0018]

[Means for Solving the Problem] This invention offers the device which carries out adjustable [ of the file system demand time out value ] dynamically based on the actual property of network connection. This invention measures the delay found out in the data communication link used, and relates to the equipment and the approach of a client side of changing a time out value dynamically, based on the present delay characteristics.

[0019] In the network system with which this invention connects source equipment to one or more target equipments, about the process which detects network failure by minimal delay and which is performed by computer, a network system has adjustable

communication-band width of face, and it operates through one of the arbitration of two or more communication links which receives intermittent cutting by failure. This invention relates to the process containing the following step. Namely, the step which initializes one network-services demand timeout period of one or more target equipments, As opposed to one each of two or more network-services demands of one or more target equipments The step which publishes a network-services demand through a communication link, The step which notifies network failure when a network-services demand is not filled within a timeout period, When a network-services demand is filled, the step which repeats and performs the step which measures between network-services demands, and the step which answers between network-services demands and changes a timeout period is included.

[0020]

[Embodiment of the Invention] The suitable mode of this invention is used in the network of computer system. <u>Drawing 1</u> shows the network configuration of the computer 100 by which this invention may be carried out. LAN or WAN interconnects a server 104 to the client workstations 106, 108, and 110. A client is respectively connected through a data communication link. The client workstation 108 is connected using an infrared link. A client 106 is connected through a telephone or a cellular telephone link. A client 110 is connected through exclusive network wiring. Each of these clients can expect a different network delay and different intermittent cutting frequency. Although the suitable mode of this invention operates with the data communication link type of the above-mentioned arbitration, it is not restricted to them. Other gestalten, such as a radio link or an optical link, may be used. Furthermore, the network protocol of gestalten of arbitration, such as a token ring and an Ethernet protocol, may be used.

[0021] Each client workstation and a server workstation have the structure shown in <u>drawing 2</u> , and similar structure. A workstation 202 contains a processor 204, memory 206, I/O-hardware-control equipment 208, and a communication controller 210. I/O-hardware-control equipment 208 supports much equipments, such as graphical display equipment 214, a keyboard 216, the retentive-memory medium 218, and the dismountable storage 220. A storage is the known type of the arbitration containing the MAG and an optical disk, or a cartridge. CCE 210 manages the communication link on the data link connection 212. This invention may be realized by the computer system configuration from which many differ. A suitable mode is realized on IBM ThinkPad computer system (IBM and ThinkPad are the trademarks of IBM).

[0022] This invention enables an application program or a system program to access the

data on a server through a communication link. Drawing 3 shows the software structure of the system by the suitable mode of this invention. An application program 302 requires the data for processing by publishing a data demand to an operating system 304. An operating system manages a system resource and carries out the role with which the application demand and system demand over a resource are filled. This invention is IBM. OS/2 It may perform on a WARP operating system, the Microsoft Windows NT operating system, and operating systems, such as a UNIX operating system. an operating system 304 fills application or a system file demand by accessing data storage 308 (or [ that a store 308 is introduced eternally ] -- or it is the data carrier of the above-mentioned arbitration of a dismountable configuration). The file service (IFS) 310 which can be introduced can be used for an operating system, using the file system access service included in an operating system. The file service which can be introduced enables the user of computer system to introduce the specific file system which supports a specific user demand. The IBM migration file synchronous (Mobile File Synch) function of the IBM high performance file system (HPFS), and an IBM Attachpak (attaching pack) and a program product is in the example of the file system which can be introduced. IBM LAN client software, such as a LAN requester, is file systems which seize a file system demand, pass it to a server and process it through a network and which can be introduced.

[0023] The file system which can be introduced seizes an operating system file service request, and serves a demand using specific service of the file system which can be introduced. The suitable mode of this invention is realized in the file system (IFS) which can be migration file synchronous introduced. The migration file synchronization IFS is designed so that migration computer ability may be supported for the user who uses a network. When a user is connected to LAN / WAN configuration through the network link 314, an application file system demand is passed to LAN / WAN server by IFS through a network interface, and is served. A migration file synchronization includes the device which carries out the cache of the activity data locally by the client system. If a migration file synchronization detects cutting of a data link 314, a migration file synchronization tends to meet the file system demand from the local cache 312. Although the file system which has a cash advance is used in a suitable mode, it is not restricted to such a system, the arbitration which seizes an operating system file system demand is used a LAN client, and this invention is obtained.

[0024] This invention is the point of processing a low file system demand, and differs from an asynchronous file transfer system. An asynchronous file transfer usually requires that a specific file should be transmitted to a client from a server. File transfer

software carries out the monitor of the transmission, all blocks are transmitted, and it guarantees being received. Some of file transfer programs make retransmission of lost data block possible. This invention serves the low file system demand of the demand which reads one record from a data file. It is published by the application program or system program 302 which does not recognize being found out locally [ these demands / data ] or remotely. This invention serves a demand transparent from a remote server. A remote server serves a demand the same with serving other local data demands of arbitration. Direct service of a demand avoids delay of a proper to a cross network transfer of the data managed by networking software.

[0025] This invention supports the low file system demand of all types. Drawing 4 shows processing of the file read-out demand from an application program. This demand is published by the application program, in order to gain the data of the addition for processing, for example, it is a demand to the next record from a data file.

[0026] An application file read-out demand is passed to an operating system, and an operating system publishes file system read-out (FS read-out) in file system service. The file system which can be introduced seizes this demand and publishes FS read-out to a server through a network. FS read-out by this invention is published together with the dynamic time out value determined so that it may be explained in full detail henceforth. Together with a time out value, through a data communication link, FS read-out is transmitted to a server and processed. A server publishes FS read-out to a physical unit, and a physical unit returns requested data. Data are returned to application through a network, the file system which can be introduced, and an operating system.

[0027] As shown in drawing 4 , time delay exists in FS read-out processing. Delay after FS read-out demand of IFS is especially published by the server until a response is received is shown as tr. If time amount tr exceeds the time out value specified by FS read-out accompanied by a time out value, the file system which can be introduced will notify cutting. As long as time amount tr is under a time out value, even if cutting temporary even if actually occurs, IFS does not cause action for cutting. It is shown by drawing 4 that the delay t2 needed as an element of tr in order to serve the network transit delays t1 and t3 and FS read-out demand is included. Since the demands (FS read-out, FS writing, etc.) of each type require a different service time, it is desirable for the total delay, therefore a time out value to change depending on the type of a demand.

[0028] This invention changes a time out value dynamically by measuring the actual time amount needed in order to serve a demand. A suitable mode sets up the upper limit and minimum of a time out value, in order to offer the maximum standby for intermittent cutting protection of the minimum level, and actual cutting. In a suitable

mode, these parameters are set up so that it may be adapted for a specific situation with a system user.

[0029] The process of this invention is shown in drawing 5 . It starts by 502 and a process is started by setting up min, max, and the present time out value. In a suitable mode, 60 seconds is used as the maximum time out value for 15 seconds as the minimum time out value. First, the present time out value is set to maximum (504). Next, a system tries the handshake to a server file system (506). When a connection request is transmitted, a connection timer starts (508). When connection is not completed before expiration of a timeout period, a system notifies failure of connection, and a file system operates by the disconnect mode until connection is established (514). If connection is completed successfully (510), the time amount length demanded for connection will be measured from a connection timer (512). In a suitable mode, in order to determine elapsed time, the system clock of 31.25 mses is read (refer to drawing 7 ). Other connection timers may be used as for example, an asynchronous DOS timer.

[0030] Next, a connect time is compared with the minimum time out value (518). When a connect time is below the minimum time out value, the present time out value is set as the minimum time out value (520). Other than this, the present time out value is then set as the sum of a connect time and assignment buffer time amount (522). In a suitable mode, buffer time amount differs corresponding to the file system call of a different type.

[0031] The present time out value set up at the time of connection is used to the next file system demand (524), and then is adjusted based on the response time to the demand. Before transmitting a file system demand to a server, the file system of this invention tests whether connection exists or not (526). When connection does not exist, cutting is notified and a file system goes into the disconnect mode (514). When connection exists, a file system demand is transmitted to a server together with a time out value (527). A file system request timer starts (530) and it is measured at the time of completion of a success (532). A system tests whether the file system demand was filled within the timeout period (528). When not filled, a system goes into the disconnect mode (514). A actual demand service time is other than this calculated. Step 518 which adjusts a time out value dynamically thru/or 522 are repeated to each file system demand.

[0032] In a suitable mode, a buffer value is established to each file system demand type. Each file system demand type can give each time out value based on a actual demand service time. The buffer value and time out value to each file system demand type are memorized in a table, and it is accessed whenever the type of demand is published. The activity of the table of the buffer value and time out value to a file system demand is shown in drawing 6 . In an alternative mode, it is based on a single buffer value and a

single time out value. The time out value of these alternative modes must permit the bigger change by many service types. A buffer value must be large enough, in order to enable processing of the longest file service request. This does not serve as the optimal cutting recognition to a file system demand of a short period.

[0033] A file system is maintained by the disconnect mode until it receives the directions which show that network connection was restored (516) (514). These directions may be generated by some approaches. In the suitable mode of this invention, a file system polls a server periodically and it judges whether the file system was connected to the server (refer to drawing 8 ). The file system of a suitable mode publishes the pass inquiry (QueryPath) demand to the directory meant so that self may be connected. A process stops until a response is received. A task sleeps for 5 seconds and it tests whether it succeeded or not. The disconnect mode is notified when unsuccessful. In a success, connection mode is notified.

[0034] Instead, whenever reestablishment of the connection with a client is carried out, a server may transmit a signal.

[0035] From above-mentioned explanation, a possible thing will be understood by this contractor in a mode with various modification suitable for this invention, without deviating from the meaning of this invention. Although the file system demand was especially used in explanation, the demand to other shared resources, such as serial equipment, a printer, and processor time amount, can be dealt with similarly. Therefore, above-mentioned explanation is mentioned as an example of this invention, and does not restrict this invention.

[0036] As a conclusion, the following matters are indicated about the configuration of this invention.

[0037] (1) In the network system which connects source equipment to one or more target equipments In what operates through one of the arbitration of two or more communication links which it is the approach minimal delay detects network failure, and said network system has adjustable communication-band width of face, and is easy to receive intermittent cutting by failure The step which initializes the network-services demand timeout period of 1 equipment of said one or more target equipments, As opposed to each of two or more network-services demands to said 1 equipment of said one or more target equipments The step which publishes said network-services demand through said communication link, The step which notifies network failure when said network-services demand is not filled within said timeout period, How to contain the step which repeats and performs the step which measures between network-services demands, and the step which answers between said network-services demands and

changes said timeout period, when said network-services demand is filled.

(2) said -- initialization -- a step -- said -- a target -- equipment -- each -- receiving -- min -- a time out value -- and -- max -- a time out value -- receiving -- a step -- said -- one -- a ** -- more than -- a target -- equipment -- said -- one -- equipment -- receiving -- said -- network services -- a demand -- a timeout period -- said -- max -- a time out value -- setting up -- a step -- containing -- the above -- (-- one --) -- a publication -- an approach .

(3) The step said measurement step remembers [ said source equipment ] read-out and the 1st system clock value to be for said system clock to a storage region including a system clock, When said network-services demand is successfully completed before termination of said timeout period The step which determines read-out and the 2nd system clock value for said system clock, said -- network services -- a demand -- between -- said -- the -- two -- a system - a clock -- a value -- said -- the -- one -- a system - a clock -- a value -- a difference -- ****** -- determining -- a step -- containing -- the above -- (-- one --) -- a publication -- an approach .

(4) When between said network-services demands is larger than said minimum time out value, the sum of between said network-services demands and a service request buffer interval or said maximum time out value is [ the step at which said modification step sets said timeout period as said minimum time out value when between said network-services demands is said below minimum time out value, and ] the approach of the aforementioned (2) publication containing the step set as the smaller one either about said timeout period.

(5) The step to which said advice step initializes an independent timer by said timeout period, and when said network-services demand is published The step which puts said independent timer into operation, and the step which cancels said independent timer when said network-services demand is filled, before said independent timer completes said timeout period, Before filling said network-services demand, when said independent timer completes said timeout period, The approach of the aforementioned (1) publication which cancels said network-services demand, cancels said independent timer, and contains the step which notifies said network failure.

(6) said -- network services -- a demand -- plurality -- network services -- a demand -- a type -- arbitration -- one -- a ** -- it is -- said -- a service request -- a buffer -- a value -- and -- said -- a timeout period -- memorizing -- having -- said -- each -- network services -- a demand -- a type -- receiving -- independent -- applying -- having -- the above -- (-- four --) -- a publication -- an approach .

(7) The approach of the aforementioned (1) publication that said network-services demand is a low file system demand.

(8) The approach of the aforementioned (1) publication which answers advice of said network failure and contains the step which sets said source equipment as a cutting condition.

(9) The approach of the aforementioned (8) publication which contains the step which tests the connection condition of said network, and the step which tests a connection condition periodically between the periods of the arbitration which has said source equipment in said cutting condition before publishing a network-services demand.

(10) predetermined -- a count -- trial -- after -- said -- network services -- a demand -- having received -- things -- said -- a target -- equipment -- it cannot notify -- things -- answering -- said -- the source -- equipment ---less -- an active state -- setting up -- a step -- re--- connection -- facing -- said -- a target -- equipment -- from -- said -- the source -- equipment -- a signal -- transmitting -- a step -- containing -- the above -- (-- nine --) -- a publication -- an approach .

(11) The approach of the aforementioned (8) publication which contains the step which fills said network-services demand from a source equipment cache when said source equipment is in said cutting condition.

(12) In the network system which is the computer program product used in the distributed computer system connected to a network system, and connects source equipment to one or more target equipments A computer usable medium including a computer read-out possible program code means for minimal delay to detect network failure is included. In that to which said network system operates through one of the arbitration of two or more communication links which has adjustable communication-band width of face, and is easy to receive intermittent cutting by failure A computer read-out possible program code means to direct to a computer that said computer program product initializes the network-services demand timeout period of 1 equipment of said one or more target equipments, As opposed to each of two or more network-services demands to said 1 equipment of said one or more target equipments A computer program product means to direct to publish said network-services demand through said communication link to computer system, A computer program product means to direct to notify network failure to computer system when said network-services demand is not filled within said timeout period, A computer program product means to direct to measure between network-services demands to computer system when said network-services demand is filled, A computer program product means to direct to answer between said network-services demands and to change said timeout period to computer system, A computer program product including a computer program product means to direct to the method computer system of **********.

(13) said -- initialization -- a sake -- a computer program -- a product -- a means -- said -- a target -- equipment -- each -- receiving -- min -- a time out value -- and -- max -- a time out value -- receiving -- as -- computer system -- directing -- a computer program -- a product -- a means -- said -- one -- a ** -- more than -- a target -- equipment -- said -- one -- equipment -- receiving -- said -- network services -- a demand -- a timeout period -- said -- max -- a time out value -- setting up -- as -- computer system -- directing -- a computer program -- a product -- a means -- containing -- the above -- (-- 12 --) -- a publication -- a computer program -- a product .

Said source equipment contains a system clock. (14) The computer program product means for said measurement A computer program product means to direct to memorize read-out and the 1st system clock value for said system clock to a storage region to computer system, When said network-services demand is successfully completed before termination of said timeout period A computer program product means to direct to determine read-out and the 2nd system clock value for said system clock to computer system, A computer program product means to direct to computer system that between said network-services demands determines as a difference of said 2nd system clock value and said 1st system clock value, ******, the computer program product of the aforementioned (12) publication.

(15) When the computer program product means for said modification is [ between said network-services demands ] said below minimum time out value, A computer program product means to direct to computer system that said timeout period sets it as said minimum time out value, When between said network-services demands is larger than said minimum time out value, Said timeout period The sum of between said network-services demands and a service request buffer interval, Or said maximum time out value is the computer program product of the aforementioned (13) publication including a computer program product means to direct to set it as the smaller one to computer system, either.

(16) A computer program product means to direct to computer system that the computer program product means for said advice initializes an independent timer by said timeout period, A computer program product means to direct to put said independent timer into operation to computer system when said network-services demand is published, A computer program product means to direct to cancel said independent timer to computer system when said network-services demand is filled, before said independent timer completes said timeout period, Before filling said network-services demand, when said independent timer completes said timeout period, The computer program product of the aforementioned (12) publication which cancels said network-services demand,

cancels said independent timer, and includes a computer program product means to direct to notify said network failure to computer system.

(17) said -- network services -- a demand -- plurality -- network services -- a demand -- a type -- arbitration -- one -- a ** -- it is -- said -- a service request -- a buffer -- a value -- and -- said -- a timeout period -- memorizing -- having -- said -- each -- network services -- a demand -- a type -- receiving -- independent -- applying -- having -- the above -- (-- 15 --) -- a publication -- a computer program -- a product .

(18) The computer program product of the aforementioned (12) publication said whose network-services demand is a low file system demand.

(19) The computer program product of the aforementioned (12) publication which answers advice of said network failure and includes a computer program product means to direct to set said source equipment as a cutting condition to computer system.

(20) Computer program product of the aforementioned (19) publication including a computer program product means to direct to test the connection condition of said network to computer system before publishing a network-services demand, and a computer program product means to direct to computer system that a connection condition tests periodically between the periods of the arbitration which has said source equipment in said cutting condition.

(21) predetermined -- a count -- trial -- after -- said -- network services -- a demand -- having received -- things -- said -- a target -- equipment -- it cannot notify -- things -- answering -- said -- the source -- equipment ---less -- an active state -- setting up -- as -- computer system -- directing -- a computer program -- a product -- a means -- re--- connection -- facing -- said -- a target -- equipment -- from -- said -- the source -- equipment -- a signal -- transmitting -- as -- computer system -- directing -- a computer program -- a product -- a means -- containing -- the above -- (-- 20 --) -- a publication -- a computer program -- a product -- .

(22) The computer program product of the aforementioned (19) publication including a computer program product means to direct to computer system that said network-services demand fills from a source equipment cache when said source equipment is in said cutting condition.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the system by which the suitable mode of this invention is realized.

[Drawing 2] It is the block diagram of the computer system with which this invention is realized.

[Drawing 3] They are an application program, an operating system, and the block diagram showing the relation during a file system program.

[Drawing 4] It is the timing chart showing the timing of the file system demand which crosses a network.

[Drawing 5] It is drawing showing the flow chart of the step of this invention.

[Drawing 6] It is drawing showing a flow chart with the detailed step of this invention in an alternative mode.

[Drawing 7] It is drawing showing the flow chart of the step in the response monitor of this invention.

[Drawing 8] It is drawing showing the flow chart of a connection test demon's step.

[Description of Notations]

100 Computer

104 Server

106, 108, 110 Client

202 Workstation

212 Data Link Connection

214 Graphical Display Equipment

216 Keyboard

218 Retentive-Memory Medium

220 Dismountable Storage

308 Data Storage

314 Network Link